A new species of Mastacembelus (Pisces, Mastacembelidae) from the upper Zambezi River, with a discussion of the taxonomy of the genus from this system

by

P. H. Skelton

Albany Museum, Grahamstown

INTRODUCTION

The upper Zambezi River sub-system as described by Bell-Cross (1972, 1974) includes the Okavango River and Swamps as well as the Zambezi River itself and its tributaries above the Victoria Falls (Fig. 1). Two *Mastacembelus* species are known and recognized from this region, although only one of the species, listed in recent check-lists of fishes (Bell-Cross 1965, 1972, 1974; Balon 1974; Jubb 1967; Jubb & Gaigher 1971; Jackson 1961, 1975) as *M. mellandi* Boulenger (1914) has been recorded from the upper Zambezi River itself. The second species, *M. mutombotombo* Pellegrin (1936), was described from a single specimen collected in the upper reaches of the Cubango or Okavango River in Angola. Both of these species are characterized by the possession of more or less 30 dorsal spines.

Recent collections of fishes taken from the Zambezi River and its tributary and flood-plain system in the Eastern Caprivi area by Mr B. van der Waal and sent to the Albany Museum, Grahamstown and the Queen Victoria Museum, Salisbury, include a species of *Mastacembelus* which cannot be referred to either *M. mellandi* or *M. mutombotombo*, or any other described species of this genus in Africa. The species is described below as new to science.

Until recently there has been a lack of sufficient suitable material of *Mastacembelus* from the rivers of the southern African region in systematic collections and, as a result, the taxonomy of these southern Africa forms, has not received much attention. Mr van der Waal's collections include specimens not only of the new species, but also specimens which can be referred to as *M. mellandi* (= *frenatus, vide infra*). Further specimens of the genus from the Okavango River in Angola have been made available for study and in view of the paucity of published data on the species, morphometric and meristic data are presented and discussed in this paper.

Measurements were taken with vernier eallipers to the nearest millimetre in the case of total, standard, pre- and post-anal lengths, and to the nearest 0,1 mm with other measurements. Vertebral and fin ray counts were taken from radiographs and from specimens cleared and alizarin-stained. Due to the specialized morphology of *Mastacembelus* the following notes on the measurements are given. Total length was taken from the tip of the rostral appendage to the extremity of the caudal rays. Standard length excludes the rostral appendage, i.e. is taken from the anterior margin of the premaxilla to the posterior margin of the hypural elements. Head

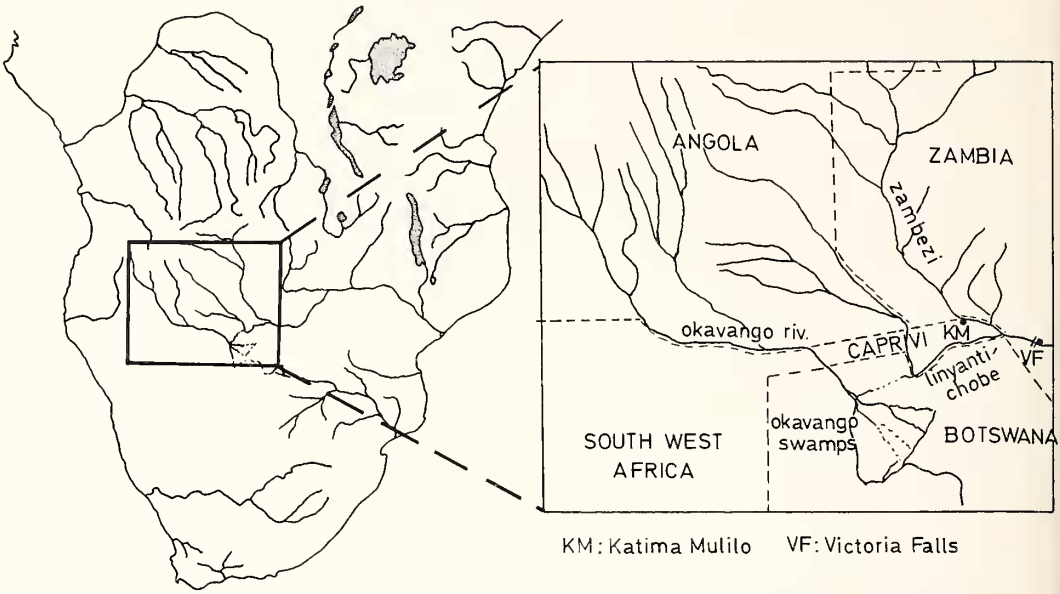

Fig. 1. Maps to show the upper Zambezi River system (as referred to in text).

length is measured from the anterior margin of the premaxilla to the posterior margin of the opercular membrane. Snout length is measured from the anterior margin of the premaxilla to the anterior margin of the eye. Eye length and interorbit distance are as defined in Hubbs and Lagler (1947) with the interorbit distance meaning the least bony width. Dorsal fin to head distance is measured from the base of the first dorsal spine to the posterior occipital margin of the head. Anus to head distance is measured from the vertical through the anus to the vertical through the posterior occipital margin of the head.

Mastacembelus vanderwaali new species (Figs 2 (a) (b), 3) Caprivi spiny eel

Holotype: Male, 153 mm SL AM/P 3183 (a);

Zambezi River mainstream, at Katima Mulilo, Eastern Caprivi. Approximately 17° 30′S., 24° 16′E. Collected by B. van der Waal and P. H. Skelton, 29 September 1975.

Paratypes: 67, males and females, 58,5–151,0 mm SL.

All paratypes collected from the same locality as the holotype. Paratypes registered and collected as detailed below. 11, males and females, 79,0–142,0 mm SL. AM/P 3138 (b) collected with the holotype.

20, males and females, 74,0–151,0 mm SL, AM/P 3450 (5 of these have been sent to the British Museum (Natural History); 5 have been cleared and alizarin-stained). Collected by B. van der Waal, 24 October 1975.

13, males and females, 98,0–142,0 mm SL, AM/P 3449 (5 of these have been sent to the American Museum of Natural History, New York; 3 are deposited in the J. L. B. Smith Institute of Ichthyology, Grahamstown). Collected by B. van der Waal, 8 October 1975.

6, females, 78,0–113,0 mm SL, AM/P 2712 (one cleared and alizarin-stained). Collected by B. van der Waal, 27 November 1974.

3, 1 male and 2 females, 83,0–107,0 mm SL, AM/P 3396. Collected by B. van der Waal, 2 September 1974.

14, males and females, 70,0–134,0 mm SL, QVM reg. No. 3451. Collected by B. van der Waal, 2 September 1974.

TABLE 1

Mastacembelus vanderwaali, new species, Morphometrics (N = 67).

Measurement	Mean	S.D.	S.E.	Range
Standard length (SL) mm	104,7	20,7	2,53	58,5 – 153,0
Total length (mm)	110,1	21,76	2,66	61,5 – 160,0
Body depth (% SL)	7,9	0,61	0,07	6,67 – 9,04
SL/body depth	12,74	0,99	0,12	10,64 – 15,0
Head length (% SL)	16,98	1,0	0,12	14,88 – 20,0
Pre-anal length (% SL)	53,5	1,52	0,19	50,71 – 58,97
Post-anal length (% SL)	46,5	1,52	0,19	41,03 – 49,29
Snout length (% SL)	29,09	1,4	0,17	25,0 – 31,71
Appendage (% eye diam.)	67,87	13,00	1,59	44,44 – 105,0
Eye diameter (% HL)	12,10	1,16	0,14	10,17 – 15,86
Interorbit (%HL)	6,5	0,75	0,09	4,76 – 8,33
Pre-dorsal—head (% SL)	10,84	0,75	0,09	9,08 – 12,86
Pre-dorsal—head (% SL)	64,1	5,11	0,62	51,89 – 73,57
Pectoral fin length (% SL)	25,55	2,51	0,31	20,69 – 32,16
Anal—head length (% SL)	42,09	1,27	0,15	39,79 – 44,35
Anal—head length (% HL)	249,0	14,19	1,73	217,0 – 275,0

Diagnosis: Mastacembelus vanderwaali differs from the only other recorded species in the upper Zambezi River, *M. mellandi*, in having fewer dorsal spines (*M. vanderwaali*, 22–26; *M. mellandi*, 27–34); in having fewer vertebrae (*M. vanderwaali*, 78–84; *M. mellandi*, 85–92), a difference which is correlated with different number of vertebrae before the interception of the leading anal pterygiophore; in the head length (*M. vanderwaali* (% SL) 16,98; *M. mellandi*, 13,87); in the head to dorsal fin distance (*M. vanderwaali* (% HL) 64,1: *M. mellandi*, 74,33); in the anal to head distance (*M. vanderwaali* (% HL) 249; *M. mellandi*, 334); and in coloration (see description below for *M. vanderwaali*, and discussion for *M. mellandi*).

Description: Based on the holotype (Fig. 2 (a) and (b)) and 67 paratypes, taken from the mainstream Zambezi River near Katima Mulilo, Eastern Caprivi. Morphometric data is derived from the holotype and 66 paratypes. Six paratypes are cleared and alizarin-stained (after the method of Taylor (1967)) one of which was not previously used for morphometric data. Vertebral counts are taken from radiographs and the 6 cleared and stained specimens. Meristic values are given with the number of individuals preceded by the symbol f in parentheses.

A species of the genus *Mastacembelus* (for generic definition see Boulenger (1916)) of

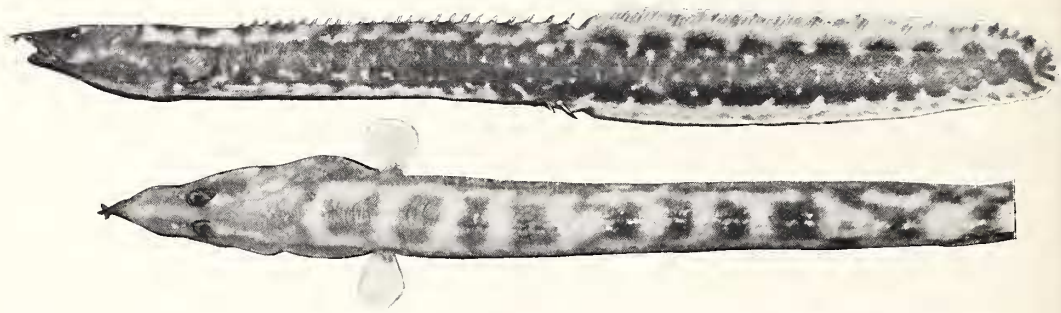

Fig. 2 (a) Holotype *Mastacembelus vanderwaali* n.sp. AM/P 3183 (a) 153 mm SL; (b) Dorsal view of anterior half of specimen, (retouched photographs).

specific morphometric characteristics as listed in Table 1. The maximum size recorded for a male specimen is 153 mm standard length and for females is 134 mm standard length. There is no marked or observed external sexual dimorphism. The body standard length (SL) is, on average, 12,74 times the depth of the body, and between 5 and 6,7 times the length of the head. The anus is closer to the posterior margin of the hypurals than it is to the anterior margin of the premaxillae, and the anal to head distance is on average 2,5 times the length of the head. The snout is 2,4 times the eye diameter and ends in an appendage bearing the anterior nostrils which is usually less than the eye diameter. The posterior fleshy angle of the mouth, when closed, reaches the vertical through the posterior nostril. The lips are well developed, broad and fleshy, and the jaws are endowed along the major portion of the length of the premaxillae and dentaries with numerous sharply pointed, posteriorly inclined teeth up to 3 deep. There are no preorbital or preopercular spines.

The dorsal fin has XXII + I (f1), XXIII + I (f7), XXIV + I (f31), XXV + I (f22) or XXXVI + I (f7) spines increasing posteriorly in size to a maximum in the last externally protruding spine. The additional spine listed above is short and does not protrude externally and is situated immediately anterior to the soft rays of the fin (Fig. 3). The dorsal fin has 64 (f1), 65 (f1), 66 (f3), 68 (f2), 69 (f2), 70 (f2), 71 (f4), 72 (f1), 73 (f1), 74 (f1) or 75 (f1) soft rays. The mean predorsal to head distance is 0,64 times the length of the head but may vary depending on the number of dorsal spines. The anal fin has II + I (f67) spines and 64 (f1), 66 (f2), 67 (f1), 68 (f1), 70 (f5), 71 (f3), 72 (f1), 75 (f3), 78 (f1), and 79 (f1) soft rays. As in the case of the dorsal fin the additional ray recorded is a short reduced non-protruding spine situated between the protruding spines and the soft rays of the fin. The dorsal, caudal and anal fins are confluent and present a varying elliptical profile. The width of the dorsal fin is about 1,5 times the width of the anal fin. The caudal fin has 9 (5 + 4) principal rays. The pectoral fins are small and fan-shaped about 0,25 times the length of the head.

The scales are small, approximately 15–20 occurring between the origin of the soft dorsal and the lateral line. Lateral line pores irregularly spaced from every 3 to 6 scales along the length of the body.

Vertebral column with 78 (f1), 81 (f3), 82 (f5), 83 (f4) or 84 (f3) vertebrae, of which there are 30 (f1), 31 (f1), 32 (f10), 33 (f4) or 34 (f1) vertebrae before the interception of the leading anal pterygiophore and 46 (f1), 47 (f1), 48 (f1), 49 (f2), 50 (f5), 51 (f5) or 53 (f1) vertebrae posterior to the interception of the leading anal pterygiophore. There are 6 (f13) or 7 (f4) vertebrae anterior to the leading dorsal pterygiophore. Each of these latter vertebrae is characterized by a blunt, broad bi- or tri-crested neural spine. There are no predorsal supraneural bones.

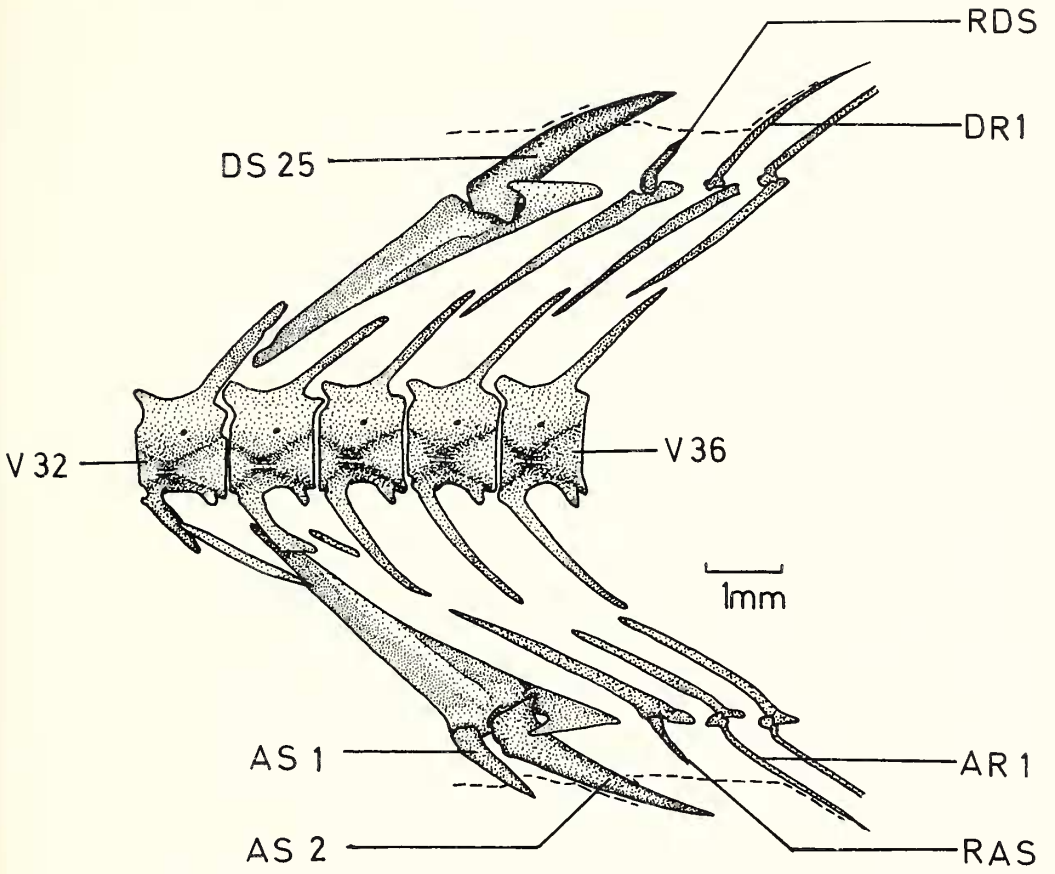

Fig. 3. Section of axial skeleton of *Mastacembelus vanderwaali* n.sp. (paratype AM/P 2712) to show the reduced ultimate spines in the dorsal and anal fins. [Abbreviations: V—vertebra, AS—anal spine, AR1—1st anal soft ray, DS25—25th dorsal spine, DR1—1st dorsal soft ray, RAS—reduced ultimate anal spine, RDS—reduced ultimate dorsal spine.]

The alimentary tract is short with a single recurved loop along its length. The gonads in both sexes extend on average 40 per cent of the length of the body cavity and are usually distally united for slightly less than half of their length. In one female paratype (AM/P 3396; 107 mm SL), in a ripe condition, the formalin-preserved ova have diameters of up to 2,8 mm.

Despite considerable individual variation there is a basic colour pattern discernible in the majority of specimens of the species. The following colour description is based on personal observation of living specimens, colour notes provided by B. van der Waal, and from preserved specimens. The holotype (Fig. 2 (a) and (b)) shows an accentuated and well-developed colour pattern of the basic type. Along the dorsal surface from behind the head to the caudal fin, the colour is predominantly yellow broken along the spiny section of the dorsal fin by a series of blackish-brown approximately rectangular patches which are more or less interconnected anteriorly between the fin and the head. A series of 9–12 dark blackish-brown ocellate reticulations

extend on either side of the soft dorsal fin impinging both on the fin membrane and on the body. A second series of ocellate reticulations occurs in similar fashion along the anal fin. These latter reticulations are slightly smaller than those of the dorsal series but impinge as with the dorsal series both on the fin and the body.

The dorsal and anal fins are predominantly yellowish but are marked with dark dashes running parallel to the rays and which leave a clear yellow margin around each ocellus. Laterally the body is variously marbled or reticulated in yellow and deep blackish-brown. When in a diffused state the colour may appear to be an olive brown and the yellow and blackish-brown contrast can vary considerably. Depending on the degree of pigment diffusion the ventral region anterior to the anal fin may be reticulated or a plain light grey in preserved specimens. In living specimens this region varies from a light cream to yellow through olive to a deep blackish-brown. The head is generally deeply pigmented blackish-brown dorsally, reticulated laterally with a lighter, usually plain ventral surface.

Distribution and habitat: The holotype and paratypes were all collected with electro-fishing gear in the rocky rapids near Katima Mulilo in the Eastern Caprivi (Fig. 1). In addition the species has been collected by B. van der Waal (pers. comm.) in Zambezi rapids near Impalila Island in the south-eastern corner of Eastern Caprivi. It is noteworthy that the species has not been encountered away from the rocky-rapid habitat despite extensive collecting efforts over several years using a wide range of techniques by Mr van der Waal throughout the Eastern Caprivi area. His collecting sites include the Zambezi River mainstream and its Caprivi flood-plain as well as the Kwando/Linyanti/Chobe River and associated flood-plain areas. This indicates that *M. vanderwaali* is probably rocky-rapid-habitat dependant and that its distribution will be governed by the occurrence of such habitats in the system. The rocks which form the rapids near Katima Mulilo are aeolian, being derived from the Kalahari sands which form the geological surface deposits in that area. Consequently the rocks are characterized by jagged rough profiles and contain numerous, often interconnected cavities in which *M. vanderwaali* exists. Long stretches of rapids occur at intervals along the course of the upper Zambezi (Bell-Cross 1974) and it may be anticipated that the species will be found in such stretches in this river sub-system at least. A population of *Mastacembelus* in the Okavango River in Angola is also referred to this species (details given in discussion).

Biology: Of fifty-three paratypes, chosen randomly for sexing by gonad inspection, twenty were males and thirty-three were females. Apart from the previously mentioned ripe female collected in early September 1974, all the specimens varied from an immature to merely active condition. No specimens were collected during the first half of the year, during which the upper Zambezi is annually subjected to flooding, which in the Caprivi area usually reaches a peak between March and May (Curson 1947). Although there is at present a lack of positive data it is possible that the breeding of *M. vanderwaali* is associated with this period of high water.

A preliminary examination of stomach contents indicates that *M. vanderwaali* is predominantly insectivorous, feeding on the macro-benthic rock fauna. Positively identifiable food items include simuliid and chironomid larvae and ephemeroteran and trichopteran nymphs. Odd filamentous algal strands and plant particles are also recorded but are probably incidental items judging from the form of the teeth and alimentary tract of *M. vanderwaali*.

Etymology: The species is named after Mr B. van der Waal, Senior Professional Officer in Charge of Fisheries in the Eastern Caprivi Government Service. Valuable systematic collections of fishes from this area, including this new species, have been submitted to the Queen Victoria and Albany Museum by Mr van der Waal.

DISCUSSION

Certain of the morphological features described above for *M. vanderwaali* are probably of generic and not necessarily of specific significance. Partially fused gonads are features observed in *M. frenatus (vide infra)* from the Zambezi system. The reduced spines preceding the soft dorsal and anal fins as described above (Fig. 3) are also present in *M. frenatus*, and would appear to be, in the case of the anal fin, equivalent to the third spine reported for certain species. It is no large difference for such a spine to be protruding or not and the third anal spine of species with three such spines is reduced in size relatively to the second spine (cf. figures in Boulenger 1916; pers. obs.). The lack of predorsal supraneural bones and the broad neural spines of the anterior vertebrae before the dorsal fin are also non-specific characters.

Matthes (1962) examined the type specimens of *Mastacembelus frenatus* Boulenger 1901, *M. taeniatus* Boulenger 1901, *M. victoriae* Boulenger 1903, and *M. mellandi* Boulenger 1914, and concluded that all these species were synonyms of *M. frenatus*. *M. mellandi* was described from a specimen collected from a tributary of the upper Zambezi and was later reported by Boulenger (1916) to be in the Congo (Zaïre) River system as well. Despite Matthes's (1962) synonymy the majority of subsequent workers on the Zambezi ichthyofauna have continued to refer to the single known species as *M. mellandi*. By way of exception Lagler *et al.* (1971) in their check-list of fishes from the Kafue River, a middle Zambezi tributary with upper Zambezi ichthyofaunal affinities, followed Matthes (1962) and recorded the *Mastacembelus* species as *M. frenatus*. Elsewhere throughout the range of the species the synonymy has been accepted, e.g. in Lake Victoria by Welcomme (1969), and Lowe-McConnell (1975). Considering the intraspecific variation in coloration, morphometric and meristic characters recorded for various *Mastacembelus* species including *M. frenatus* by Matthes (1962) and in the present paper (Tables 1–4), I am of the opinion that the synonymy of Matthes (1962), in which good reason has been detailed, is valid for the species known as *M. mellandi* in the Zambezi River system, and is adopted hereafter.

In the Caprivi area *M. frenatus* is easily distinguished from *M. vanderwaali* in coloration. Due to a poverty of taxonomic data published for *M. frenatus* from the Zambezi River and for comparative purposes a morphometric (Table 2) and meristic and colour description for the species is offered here. Material examined is recorded in Appendix I, colour was recorded from live fishes and the preserved material, soft ray counts are taken from two cleared and stained specimens and suitable radiographs.

In contrast to the generally bold markings of *M. vanderwaali*, *M. frenatus* from the Caprivi area is either plain or finely spotted or reticulated, becoming more marked posteriorly. The ground colour is brown and a usually outstanding feature is a lighter reddish brown dorso-lateral band extending from the tip of the snout to the latter half of the soft dorsal fin where it progressively merges with the reticulations of this part of the body. The soft dorsal and anal fins have a series of ocellate spots along the bases. Dorsally the reddish band is more or less divided by a series of dark brown markings about the bases of the dorsal spines, a feature well illustrated by a figure of *M. taeniatus* (= *M. frenatus)* in Steindachner (1915). The fin membranes are marked with a series of dashes separated from the ocellate spots anteriorly but merging with them posteriorly to form a reticulated pattern.

The range of variation recorded for dorsal spines as well as dorsal and anal soft rays and for vertebral counts of *M. frenatus* is wide and underlines the caution which must be given in attaching specific significance to these characters alone. Dorsal spines range from XXVII + I (f1) through XXVIII + I (f2), XXX + I (f3), XXXI + I (f9), XXXII + I (f9), XXXIII + I (f4) to XXXIV + I (f1), all individuals having a reduced non-protruding ultimate spine as reported for *M. vanderwaali* above. Anal spine counts were all II + I (f31), likewise in each case with a third non-protruding spine prior to the first soft ray. Accurate soft ray counts are available from two

cleared and stained specimens (AM/P 3295 & AM/P 3250) and suitable radiographs of five specimens (AM/P 3441 (f1), QVM 1843 (f2), QVM 0322 (f1), QVM 2074 (f1). Dorsal soft rays were less than the number of anal soft rays in six of the seven specimens having respective values as follows (dorsal soft rays first): 70–76, 81–83, 69–66, 72–76, 72–76, 72–73, 74–78. It is clear that there is a broad variation in soft fin ray counts for both *M. frenatus* and *M. vanderwaali* and thus there appears to be no specific distinction in this character for these species. Vertebral counts of nine specimens are available: 85 (f1), 86 (f1), 89 (f5), 90 (f1), 91 (f1). As in *M. vanderwaali* there are 6 (f5) or 7 (f4) vertebrae before the interception of the leading dorsal pterygiophore, and from 35 (f1), 36 (f1), 37 (f1), 38 (f2) to 39 (f4) vertebrae before the interception of the leading anal pterygiophore. It would appear from this brief analysis that the larger number of vertebrae recorded for *M. frenatus* than *M. vanderwaali* is due to an increased number of vertebrae before the anal fin, which correlates well with the larger number of dorsal spines in the former species.

Morphometric analysis for *M. frenatus* from the upper Zambezi follows in Table 2.

TABLE 2

Mastacembelus frenatus (= *mellandi*) from the upper Zambezi River system, Morphometric analysis (N = 31).

Measurement	Mean	S.D.	S.E.	Range
Standard length (SL)	138,68	49,74	8,93	62,0 – 235,0
Total length (MM)	144,81	51,89	9,32	64,5 – 242,0
Body depth (% SL)	7,98	0,74	0,13	6,3 – 9,49
SL/body depth	12,62	1,2	0,22	10,53 – 15,84
Head length (% SL)	13,87	1,39	0,25	9,57 – 16,46
Pre-anal length (% SL)	54,89	1,84	0,33	50,65 – 58,33
Post-anal length (%SL)	45,11	1,84	0,33	41,67 – 49,35
Snout length (%HL)	30,78	2,54	0,46	26,47 – 35,0
Appendage (% eye diam.)	84,58	20,57	3,69	55,0 – 146,66
Eye diameter (%HL)	11,5	1,63	0,29	7,5 – 14,63
Interorbit (%HL)	8,28	0,94	0,17	6,52 – 10,57
Pre-dorsal—head (%SL)	10,27	0,93	0,17	8,9 – 13,04
Pre-dorsal—head (% HL)	74,33	7,08	1,27	64,00 – 103,1
Pectoral fin length (% HL)	27,1	2,78	0,5	22,76 – 35,11
Anal—head length (% SL)	45,7	1,47	0,26	42,86 – 49,07
Anal—head length (% HL)	334,0	38,19	7,09	269,0 – 498,0

The morphometric values of *M. frenatus* (Table 2) and *M. vanderwaali* (Table 1) are generally close except with regard to maximum standard (or total length) attained and the anal to head distance (expressed as % head length). With regard to this latter measurement although the range shown by *M. frenatus* apparently overlaps that of *M. vanderwaali* extensively the recorded range is misleading as the individual fish with the range extremes are exceptional and a more reliable range taken from the remaining specimens would be (% HL) 304 to 369, as well beyond the range of *M. vanderwaali*. Again this difference between these species can be correlated to the difference in the number of vertebrae before the anal fin as recorded above. The maximum standard length recorded deserves comment as it appears to be a feature of *M. vanderwaali* to be

a shorter species (when adult) than *M. frenatus*. There are indications that *M. vanderwaali* can be sexually active at less than 100 mm standard length, whereas *M. frenatus* were all larger than this when showing any sign of sexual activity in the state of the gonads. The type specimen of *M. mellandi* with a total length of 310 mm (Boulenger, 1914) is almost twice the length of the largest *M. vanderwaali* from the type series.

Boulenger (1917) described from a single specimen a second species of *Mastacembelus* from the upper Zambezi (taken near Shesheki in, what is now, Zambia), viz. *M. thompsoni*. Jubb (1967) placed *M. thompsoni* in synonymy with *M. frenatus* (= *mellandi*) but did not detail reason for so doing. An examination of the type specimen (SAM 14542) at present housed in the Albany Museum, indicates that the specimen (Table 3) differs from *M. frenatus* (Table 2) significantly only in the body depth to standard length ratio. The high ratio recorded is not due to poor preserved condition as a similar ratio was recorded by Boulengar (1917) in the original description using total length, but may be a reflection of poor condition in life. Not only is the specimen large (i.e. long) (SL 272 mm) but the extensive collecting in the upper Zambezi close to Shesheki by Mr van der Waal indicates that there is only one species growing to this size and with as many dorsal spines, viz. *M. frenatus*. The synonymy is therefore upheld.

TABLE 3

Mastacembelus thompsoni, holotype, Morphometrics (Dec. 1975)

Measurement	
Standard length (SL) mm	272,0
Total length (mm)	281,0
Body depth (% SL)	5,1
SL/body depth	20,0
Head length (% SL)	12,83
Pre-anal length (% SL)	50,36
Post-anal length (% SL)	49,53
Snout length (% HL)	30,3
Appendage (% eye diam.)	116,0
Eye diameter (% HL)	9,09
Interorbit (% HL)	8,48
Pre-dorsal—head (% SL)	8,82
Pre-dorsal—head (% HL)	72,72
Pectoral fin length (% HL)	27,27
Anal—head length (% SL)	43,38
Anal—head length (% HL)	357,0

Pellegrin (1936) described *Mastacembelus mutombotombo* from a single specimen taken from the upper reaches of the Cubango or Okavango River in Angola. The species was described with a dorsal spine count of 30, well above that encountered for *M. vanderwaali* from the upper Zambezi.

Poll (1967) drew attention to the close resemblance of *M. mutombotombo* to what was identified as *Mastacembelus batesii* Boulenger (1911). It is noted that Poll's (1967) *M. batesii*

bears a strong resemblance, judging from his figure and description, to the Zambezi form of *M. frenatus*. *Mastacembelus mutombotombo* has not been recorded in southern African collections until recently when specimens collected by the State Museum, Windhoek, in the Okavango River (Cubango) in Angola (fig. 1) were referred to this species. A sample of these specimens was made available for study and an analysis is given below.

The general facies and coloration of these specimens is close to that recorded for *M. vanderwaali* above. Morphometrics of the specimens are recorded in Table 4 below. Dorsal spines range from XXVI + I (f1), XXVII + (f5), XXVIII + (f4) to XXIX + I (f2) and anal spines II + I (F12). The range for dorsal soft rays is 62 to 71 and for anal fin soft rays is 63 to 70. The relationship between the number of dorsal soft rays and anal soft rays appears to be irregular and for the eleven specimens counted the values are as follows (dorsal precedes anal count): 69–69, 62–13, 69–69, 65–66, 62–69, 65–69, 71–70, 66–65, 68–67, 65–70, 71–70. The number of vertebrae range from 83 (f1), 84, (f4), 85 (f2), 86 (f1) to 87 (f3). There are 33 (f1), 34 (f4), 35 (f3) or 36 (f3) vertebrae before the leading anal pterygiophore and from 49 (f1), 50 (f7), 51 (f2) to 53 (f1) posterior to the leading anal pterygiophore.

TABLE 4

Mastacembelus species: Okavango River, Caiundo, Angola (N = 12)

Measurement	Mean	S.D.	S.E.	Range
Standard length (SL) mm	102,0	15,23	4,4	79,0 – 140,0
Total length (mm)	107,0	16,07	4,64	83,0 – 147,0
Body depth (% SL)	7,86	0,76	0,22	7,13 – 9,9
SL/body depth	12,81	1,08	0,31	10,11 – 14,02
Head length (% SL)	16,81	0,52	0,15	16,00 – 17,37
Pre-anal length (% SL)	56,15	1,47	0,42	53,48 – 57,97
Post-anal length (% SL)	43,85	1,47	0,42	43,03 – 46,52
Snout length (% HL)	28,99	1,87	0,54	26,49 – 33,54
Appendage (% eye diam.)	62,00	5,37	1,55	50,0 – 68,42
Eye diameter (% HL)	11,89	0,78	0,23	10,57 – 13,43
Interorbit (% HL)	6,36	0,72	0,21	5,3 – 7,61
Pre-dorsal—head (% SL)	10,75	0,65	0,19	9,8 – 11,67
Pre-dorsal—head (% HL)	63,98	4,3	1,24	56,4 – 70,89
Pectoral fin length (% HL)	21,93	2,13	0,62	19,21 – 25,44
Anal—head length (% SL)	44,19	1,54	0,45	42,17 – 45,92
Anal—head length (% HL)	263,0	12,4	3,6	244,0 – 279,0

The morphometric values for this species of *Mastacembelus* from the Okavango River (Table 4) compare very similarly with those of *M. vanderwaali* (Table 1). Of particular note are the points of similarity between the two samples, which are points of difference between *M. vanderwaali* and *M. frenatus*. The similarity of overall size range is significant in the light of the discussion of this recorded above. Sexually mature specimens are present in the Okavango material which has a sample maximum size of 140 mm SL. Certain differences in the meristic values of *M. vanderwaali* and the Okavango material exist. The vertebral number of the Okavango specimens proceeds higher than for *M. vanderwaali* mainly as a result of increased

number of vertebrae before the anal fin. This increase is reflected in the increased number of dorsal spines of the Okavango specimens, the mode value of which is still less than the mode recorded for *M. frenatus* above. Of particular significance is the similarity of the Okavango specimens in the anal fin to head distance (as % head length) with *M. vanderwaali* and in this same respect its dissimilarity with *M. frenatus*. It is thus concluded that the Okavango specimens are best referred to as a form of *M. vanderwaali* and not of *M. mutombotombo* as described by Pellegrin (1936).

The holotype of *Mastacembelus mutombotombo* Pellegrin (1936) has been received on loan from the Museum National d'Histoire Naturelle, Paris (Registered No. –36–157) and the following analysis and consideration of the specimen and species is thus possible. Table 5 records a morphometric analysis of the specimen. Vertebral and fin ray counts taken from a radiograph are as follows: total vertebrae 91, 37 pre-anal (38 pre-caudal) and 54 post-anal (53 caudal) vertebrae; 6 vertebrae before the dorsal fin, XXX + I dorsal spines, II + I anal spines, 64 dorsal soft rays, 68 anal soft rays. Scale counts are as recorded by Pellegrin (1936) and although the coloration is presently faded, feint traces of the pattern recall that of *M. frenatus* above.

TABLE 5

Mastacembelus mutombotombo, holotype (Mus. Nat. d'Hist, nat., Paris: –36–157)

Measurement	
Standard length (SL) mm	221,0
Total length (mm)	231,0
Body depth (% SL)	7,69
SL/body depth	13,0
Head length (HL) (% SL)	13,12
Pre-anal length (% SL)	52,49
Post-anal length (% SL)	47,51
Snout length (% HL)	28,62
Appendage (% eye diam.)	87,1
Eye diameter (% HL)	10,69
Interorbit (% HL)	6,9
Pre-dorsal—head (% SL)	9,5
Pre-dorsal—head (% HL)	72,41
Pectoral fin length (% HL)	22,07
Anal—head length (% SL)	43,89
Anal—head length (% HL)	334,5

Pellegrin described the coloration as uniformly brown with the fins as greyish or yellowish and darker markings along the soft dorsal and back. Beyond a slight discrepancy in the standard length and possibly a longer snout length the values recorded in Table 5 fit the original description.

The morphometric values for *M. mutombotombo* are also well within the range recorded for *M. frenatus* in Table 2, and there is no disagreement in the dorsal spine count of the specimen with those of *M. frenatus*. The soft ray counts differ from that recorded by Pellegrin (1936) (dorsal 60, anal 60) and although the specimen's counts for the soft fin rays are slightly less than

the values recorded for the six *M. frenatus* specimens above they are sufficiently close and provide no grounds for specific distinction. I consider therefore that *M. mutombotombo* to be a syn. nov. of *M. frenatus*.

It is fairly certain that *M. vanderwaali* is confined to the rocky-rapid environment reported under the habitat of the species above. Although this environment is typical for the genus as shown by Corbet (1961), Lowe-McConnell (1975) and others, the narrow habitat preference of *M. vanderwaali* in contrast to the less demanding *M. frenatus* is reflected in the only recent, yet relatively belated appearance of *M. vanderwaali* to science. The case history of *Clariallabes platyprosopos* a closely sympatric species apparently confined to the same environment gives further explanation to this situation. *C. platyprosopos* was described by Jubb (1964) from a single specimen collected in the upper Zambezi in 1955. No further specimens were collected before it was described (Jubb 1964) and no specimens are known to have been collected or reported on until 1974, when Mr. B. van der Waal submitted specimens collected with electro-fishing gear in the rapids at Katima Mulilo to the Queen Victoria Museum, Salisbury.

The meristic differences between the population in the Okavango River and that from the Zambezi in the Caprivi area lends support to the thesis that the swampy Okavango/Linyanti/Chobe connection between these populations is an effective ecological barrier to the species. In this regard a detail of the habitat in which the Okavango specimens were collected (Penrith *in litt.*) is pertinent "rapid moving water between large rocks and solid rock bed".

The following note is proffered as a point of correction on the spelling and authorship of the genus *Mastacembelus* and which has varied in certain recent southern African publications. The correct spelling in agreement with the family Mastacembelidae is *Mastacembelus*. Correct authorship is given to Scopoli 1777 who was the first to use the name in bi-nomial combination.

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APPENDIX

Mastacembelus frenatus; material examined.

Abbreviations: AM/P—Albany Museum, Grahamstown.
SAM—South African Museum, Cape Town (note: specimen housed in Albany Museum).
QVM—Queen Victoria Museum, Salisbury.
SMW—States Museum, Windhoek, South West Africa.
PNHM—Museum National D'Histoire Naturelle, Paris.

QVM 2074	1 specimen (231 mm SL) Luanginga River, Kalabo, Zambezi River system, Zambia. March 1964, R. Japp.
QVM 1843	2 specimens (183; 198 mm SL) Luanginga River, Kalabo, Zambezi River system, Zambia. March 1964, R. Japp.
QVM 0322	1 specimen (186 mm SL) Mohembo, Okavango River. 3 December 1958, D. C. Culver-Letter.
AM/P 34	3 specimens (214; 192; 186 mm SL) Victoria Falls National Park, Zambezi River, Rhodesia. 6 August 1959, R. A. Jubb.
AM/P 1780	2 specimens (206; 173 mm SL) upper Zambezi River.
AM/P 2381	1 specimen (140 mm SL) (head damaged) Schuckmannsburg, Eastern Caprivi, Zambezi River system. 12 October 1973, B. van der Waal.
AM/P 3132	3 specimens (84; 106; 116 mm SL) Drainage channel, Zambezi flood-plain, near Schuckmannsburg, Eastern Caprivi. 27 September 1975, B. van der Waal and P. H. Skelton.
AM/P 3295	5 specimens (85; 89; 97; 102; *113 mm SL) (*cleared and alizarin-stained) Backwater (mulapo) from Zambezi River, Eastern Caprivi. 30 August 1975, B. van der Waal.

AM/P 3351	3 specimens (152; 155; 235 mm SL) Zambezi River system. Schuckmannsburg, Eastern Caprivi. 1974–5, B. van der Waal.
AM/P 3371	1 specimen (123 mm SL) Zambezi River system, Eastern Caprivi. 1974–5, B. van der Waal.
AM/P 3425	1 specimen (108 mm SL) stream, Impalila, Zambezi River system, Eastern Caprivi. 7 August 1975, B. van der Waal.
AM/P 3441	2 specimens (105; 170 mm SL) Nabwizu, Eastern Caprivi, upper Zambezi system. 23 July 1975, B. van der Waal.
AM/P 3350	4 specimens (79; 97; 103; *109 mm SL) (*cleared and alizarin-stained) Malila backwater, Eastern Caprivi, Zambezi River system. 27 August 1975, B. van der Waal.
AM/P 3554	2 specimens (62; 100 mm SL) Malila backwater, Eastern Caprivi, Zambezi River system. 29 August 1975, B. van der Waal.
SAM 14542	Holotype, *Mastacembelus thompsoni*, Shesheki, Northern Rhodesia (Zambia). Rev. L. Jalla.
SMW P.777	*Mastacembelus* cf. *vanderwaali*, 12 specimens Okavango River, Caiundo, Angola. 15 October 1972, M. J. Penrith, J. Baptista.
PNHM –36–157	Holotype, *Mastacembelus mutombotombo*, Cubango River, Angola. Dr Monard.

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